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ORIGINAL PAPER

Social Cognitions and Mental Health as Predictors of Adolescents' Mindfulness Practice

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Abstract

Objectives While practicing mindfulness can potentially mitigate and prevent mental health problems among adolescents, mindfulness programs delivered in schools do not uniformly lead to uptake of mindfulness practice. This low adherence threatens the internal validity of mindfulness trials and may hinder the alleviation of mental health problems in youth who fail to take up potentially effective techniques. Consequently, it is vital to investigate what predicts uptake of independent mindfulness practice in such interventions.

Methods Using path analyses, this study investigates whether social cognitions from the Reasoned Action Approach and initial mental health predict mindfulness practice among 1646 adolescent recipients of the school-based Healthy Learning Mind mindfulness intervention.

Results In line with the Reasoned Action Approach, descriptive and injunctive norms, and positive and negative outcome expectations predicted intention to practice mindfulness ($R^2 = .37$, $p < .001$), which in turn predicted different measures of mindfulness practice itself ($R^2 = .09$–$.17$, $p < .001$). Neither perceived behavioral control nor mental health variables (depressive symptoms, internalization and externalization of difficulties, and resilience: $R^2 = .01$, $p > .05$) were associated with mindfulness practice after the intervention.

Conclusion Social norms and outcome expectations are potential intervention targets to increase mindfulness practice motivation and behavior among adolescents.

Keywords Behavior change · Motivation · Mindfulness · Reasoned Action Approach · Health promotion · School-based intervention · Normative beliefs

The World Health Organization ("Child and adolescent mental health," 2018) has stressed that mental health disorders, which affect 10–20% of adolescents worldwide, are a stigmatizing and crippling impediment to development, educational attainment, and prosperity. One promising method to strengthen adolescents' mental health is teaching mindfulness practices in schools. Meta-analyses and systematic reviews have found some evidence that school-based mindfulness programs have cognitive and emotional benefits (Carsley et al. 2018; Felver et al. 2016; McKeering and Hwang 2018; Zenner

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et al. 2014; Zoogman et al. 2015). The reviewed studies have reported improvements in attention, learning outcomes, coping, resilience, classroom engagement and behavior, social-emotional competence, and positive affect and decreases in stress, anxiety, depressive symptoms, and suicidal ideation.

Mindfulness constitutes self-regulated, open, curious, and accepting awareness of present moment experiences (Bishop et al. 2004). Mindfulness practice may include formal exercises performed during an allocated period of time (e.g., body scan, an exercise guided by audio file) or informal exercises performed in everyday life (e.g., eating mindfully). Mindfulness programs frequently advise participants to complete exercises taught during the sessions as homework. Their goal is for participants to continue mindfulness practice after the programs end. However, sustaining practice outside sessions has been infrequent (Zenner et al. 2014).

Without sufficient mindfulness practice, mindfulness benefits can neither be evaluated nor attained. Mindfulness research has been criticized for being poor quality, e.g., small samples, heterogeneity of programs, timing of measurements, and lack of active controls and randomization (Felver et al. 2016; McKeering and Hwang 2018; Zenner et al. 2014), but without practice, better quality research will continue to have difficulties assessing the effects of mindfulness practice. Moreover, if mindfulness practice continues to produce positive outcomes, the knowledge of the mechanisms behind mindfulness practice uptake is valuable to enable more people to reap the benefits. One of the meta-analyses on school-based mindfulness programs found that intensity of mindfulness practice in both the sessions and at home accounted for 21% of the variance in positive psychological outcomes in pre-post design studies and 52% of the variance in controlled studies (Zenner et al. 2014). Another of the meta-analyses on mindfulness interventions involving youth did not find amount of practice or recommendations of independent practice and benefits to moderate the positive outcomes, but it only included practice in the programs omitting any effects due to independent practice (Zoogman et al. 2015; less than half of the studies between these two meta-analyses were overlapping). With regard to the specific mindfulness program used in the present study, the ".b" program, positive outcomes were associated with independent practice in some studies (Huppert and Johnson 2010; Kuyken et al. 2013), while not in others (Johnson et al. 2016, 2017). However, in the latter experiments, a lower percentage of participants reported practicing independently to begin with so it could be that more practice would have been needed to find an association. This low independent practice adherence calls for research into predictors of home practice. However, to date, there is a paucity of empirical evidence (from our English language searches) on what factors predict mindfulness practice at home for adolescents or adults.

School-based mindfulness programs aim to increase students' mental well-being, but it is also possible that initial mental health status predicts uptake of mindfulness practice. Qualitative and mixed method studies have found that participants frequently mention a desire to reduce mental health problems as a reason for practicing mindfulness (Banerjee et al. 2017; Dariotis et al. 2016; Laurie and Blandford 2016; Pepping et al. 2016). Still, most young people with mental health problems do not seek help (Gulliver et al. 2010). People with mental health problems (e.g., depression) may feel helpless, i.e., that there is nothing that can be done to improve their mental health (Seligman 1974), which may hinder uptake of mindfulness practice. Indeed, quantitative studies have found that various mental health problems are associated with meditation program attrition or perceived barriers to meditation (Banerjee et al. 2018; Crane and Williams 2010; Delmonte 1980, 1984, 1988; Whitford and Warren 2019; Williams et al. 2012; Williams et al. 1976). Other studies have found that intention or practice itself is not associated with severity of problems (Bistricky et al. 2018; Rizer et al. 2016). In other words, there are two contradicting hypotheses as to whether poor mental health may spur or inhibit taking up a mental health-ameliorating behavior. Almost all of these studies involved older participants; the research on youth is even more lacking.

Besides initial mental health potentially predicting uptake of mindfulness practice, social cognitive factors such as behavioral intention can also predict mindfulness practice as a behavior. The Reasoned Action Approach (RAA) is one well-established behavioral theory that outlines key social cognitive predictors of behavior (McEachan et al. 2016; Rivis and Sheeran 2003; Sheeran et al. 2016). Building on its predecessor, The Theory of Planned Behavior, (TPB), the RAA suggests that a behavior is predicted by the intention to perform the behavior. Intention in turn is predicted by outcome expectations (attitudes), perceived norms, and perceived behavioral control (self-efficacy), which are determined by behavioral, normative, and control beliefs. Perceived norms include both injunctive norms, i.e., beliefs about whether significant others approve of the behavior, and descriptive norms, i.e., what peers or significant others are perceived to do. Descriptive norms have been identified as a factor especially relevant for youth (Rivis and Sheeran 2003). There is evidence that descriptive norms and perceived behavioral control may directly predict the behavior in addition to predicting intention (McEachan et al. 2016). Past behavior has also been identified as a predictor in the RAA model, while not undermining the significance of the other predictors (Fishbein and Ajzen 2010; Hagger et al. 2018).

There have been some studies investigating the RAA with regard to stress-reduction technique uptake. Seven evaluations found outcome expectations to be associated with uptake, but three did not (Beattie et al. 2019; Bistricky et al. 2018; Erbe et al. 2018, 2019; Lederer and Middlestadt 2014; Rizer et al. 2016). Five evaluations of perceived norms found associations with uptake while two did not, with some evidence suggesting that descriptive norms could be more influential than injunctive norms (Beattie et al. 2019; Bistricky et al. 2018; Erbe et al. 2018, 2019; Lederer and Middlestadt 2014; Rizer et al. 2016). One evaluation of perceived behavioral control found an association with uptake or intention, but two did not (Beattie et al. 2019; Erbe et al. 2019; Lederer and Middlestadt 2014). One qualitative evaluation of a related concept, perceived barriers, found that participants saw perceived barriers to meditation, but three quantitative evaluations did not find an association (Bistricky et al. 2018; Erbe et al. 2018; Rizer et al. 2016).

To examine social cognitions and mental health as predictors of mindfulness practice uptake in youth, the current study used a dataset from a large cluster-randomized controlled trial (cRCT) called Healthy Learning Mind (HLM; Volanen et al. 2016). The 9-week Healthy Learning Mind program was conducted in southern Finnish schools among 12–15-year-olds. The trial tested mindfulness against an active control (relaxation) and a passive control (no treatment) on three co-primary outcomes: resilience, socio-emotional functioning, and depressive symptoms (Volanen et al. 2020). The baseline levels of these variables were used as predictors in this study. The current study also investigated gender differences in levels of social cognitive and practice variables and in the RAA and initial mental health models in order to begin to understand better why girls and women have reported experiencing greater benefits from practicing mindfulness (Rojiani et al. 2017; Volanen et al. 2020). The primary research questions are as follows: Do resilience, socio-emotional functioning, and depressive symptoms at baseline predict mindfulness practice during the intervention and 17 weeks after the intervention? Do post-intervention outcome expectations, perceived behavioral control, and perceived norms predict intention to practice mindfulness? Do intention, descriptive norms, and perceived behavioral control predict mindfulness practice at home during the intervention and in the 17 following weeks? The secondary research questions are: Do the average levels of social cognitions and mindfulness practice after the intervention differ between boys and girls? Are there gender differences in the associations between mental health and practice? Are there gender differences in the associations in the RAA model?

Methods

Participants

The current study analyzes data from participants from the mindfulness intervention arm ($N = 1646$) of the HLM program, which included 804 girls and 835 boys from 12 to 15 years old ($M_{Age} = 13.63$, $SD_{Age} = 1.30$). Mother tongue, which is a historically significant division in Finland with a 5% Swedish-speaking minority, included Finnish ($n = 966$), Swedish ($n = 160$), and other ($n = 101$). As for grade, 37.7% were sixth graders (37.7% of girls; 37.6% of boys), 17.9% seventh graders (18.3% of girls; 17.6% of girls), and 44.5% eighth graders (44.0% of girls; 44.8% of boys). Those who did not have relevant data at the follow-ups (22% of girls and 26% of boys were missing data on all this study's 10-and-26-week variables) were more likely to be seventh graders rather than sixth or eighth graders ($\chi^2(2) = 91.73$, $p < .001$, $V = .24$) and had lower internalization ($F(1,1644) = 273.73$, $p < .001$, $\eta 2 = .143$) and higher externalization ($F(1,1221) = 8.78$, $p = .003$, $\eta 2 = .007$) mean scores at baseline. However, gender ($\chi^2(1) = 4.73$, $p = .030$, $\phi = .05$), resilience ($F(1,1226) = 0.67$, $p = .413$, $\eta 2 = .001$), and depressive symptoms ($F(1,1160) = 3.11$, $p = .078$, $\eta 2 = .003$) were not significantly related to having missing data on all this study's follow-up variables.

Procedure

In the HLM trial, 247 schools in southern Finland were contacted, of which 56 agreed to participate in the study. After stratifying by language of teaching, grade level, and school location, classes within the schools were randomly assigned to a mindfulness intervention arm (85 classes), a relaxation arm (79 classes), or a non-treatment arm (28 classes). All participants and their parents completed informed consent forms and were notified that participation was voluntary and withdrawal was possible. The ethical review board of the University of Helsinki reviewed the study protocol (Statement 1/2014). See the study protocol for more information about the trial (Volanen et al. 2016).

Students in classes that had been allocated to the mindfulness intervention arm received an intervention based on the ".b" program. The .b program is composed of 9 weekly, in-class lessons introducing the concept of mindfulness and several mindfulness techniques. Participants were instructed to do the mindfulness exercises at home after each lesson, and facilitators asked if they had practiced them during the next session. Facilitators were not their teachers but were themselves experienced mindfulness practitioners. Surveys used in the current study were administered at baseline (0 weeks), 10 weeks, and 26 weeks. The trial was delivered in four batches from 2014 to 2016.

Measures

The mental health, social cognitive, and mindfulness practice variables used in the present study are presented in Table 1. All measures used in the surveys can be found in the trial protocol (Volanen et al. 2016). The same mental health variables are used in the current study as were used in the main outcome paper for consistency. They were resilience, as measured by the short version of the Resilience Scale (Losoi et al. 2013; Wagnild 2009; Wagnild and Young 1993), depressive symptoms as measured by the short form of Beck's Depression Inventory [the item about suicidal ideation was omitted without compromising reliability $\alpha_{girls} = 0.82$, $\alpha_{boys} = 0.86$ or transferring many participants to a different classification, e.g., from symptomatic to non-symptomatic (Kaltiala-Heino et al. 1999; Kosunen et al. 2003)], and socio-emotional functioning as measured by the Strengths and Difficulties Questionnaire. However, the Strength and Difficulties Questionnaire was used differently; instead of using the Total Difficulties Scale, it was broken down into subscales: Internalization of Difficulties and Externalization of Difficulties. Goodman et al. (2010) recommend using the internalization and externalization of difficulties in low-risk samples. In addition, gender differences gave further reason for breaking down the Total Difficulties scale: Girls had a significantly higher internalization score ($t = 3.59$, $p < .001$), boys had a significantly higher externalization score ($t = -2.99$, $p = .003$), and there were no significant differences on the total difficulties scale ($t = 0.49$, $p = .622$).

The RAA variables were formed based on recommendations from Francis et al. (2004). The six-item outcome expectations measure was separated into negative and positive domains because the items loaded on two different factors in an exploratory factor analysis. There was a sixth option of "I don't know," which only amounted to about 10% of responses and was omitted in the mean scores. Injunctive norms were measured by two items about parents' and friends' approval of mindfulness practice, and descriptive norms by one item about friends' mindfulness practice. Intention was measured with the following single item "During the next months, I will use the exercises I have learned to relax and calm my mind" rated on a 7-point scale (from "1. Totally disagree" to "7. Totally agree").

Five mindfulness practice measures at different time points were used to test for convergent validity of self-reported practice, i.e., different measures of self-reported practice were analyzed to see if similar results were obtained. Three of the measures were mean scores while two were single items. The mean score variables covered 1–9 weeks, 10–26 weeks, and 23–26 weeks. They were an average of responses to frequency of practice of a type of exercise. The items measuring mindfulness practice at 1–9 weeks asked about 11 exercises specifically while the 10–26 and 23–26 week items measured exercises more generally, e.g., short exercises. The single items at 10 and 26 weeks were even more general measures of mindfulness practice; doing a mindfulness exercise was listed as one of many activities performed to relax. Only the measure of practice at 10–26 weeks is shown in the body of the paper for simplicity's sake; the other practice measures can be accessed in the supplementary files.

Data Analyses

The RAA model and the mental health model were tested using path analyses (adjusted for grade level). Standard errors and confidence intervals were adjusted for clustering at the class level. Multi-group analyses were used to test whether the associations within the RAA model and the mental health model varied across girls and boys. In these analyses, the chi-square statistic of the constrained model (the regression paths were forced to be similar between genders) was compared with that of the unconstrained model (the paths were allowed to vary freely) using a chi-square difference test (taking into account the MLR scaling-correction factor). Full Information Maximum Likelihood estimator with robust standard errors was applied to handle missing data and to take into account deviations from normality and non-independence of observations. Mean differences in the study variables between girls and boys were assessed using independent t tests. The standardized mean-difference effect size (d) was computed using an online calculator (Wilson 2018). Holm-Bonferroni Sequential Correction was applied to correct for multiple comparisons.

In light of calls to justify p value cut-offs (Lakens et al. 2018), we used $p = .01$ rather than the common $p = .05$ as a significance threshold due to the large sample size of the study (n varied between 938 and 1646 in different analyses). To evaluate the size of the direct effect in the path models, we used the references recommended by Cohen (1992) for standardized regression coefficients: small = 0.20, medium = 0.50, and large = 0.80. Skewness (> 2) and kurtosis (> 7) cut-offs were based on Finney and DiStefano (2013). The model fit was evaluated with several types of fit indexes including chi-square statistic, standardized root mean square residual (SRMSR), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and root mean square error of approximation (RMSEA). As suggested by Hu and Bentler (1999), we defined TLI and CFI values ≥ 0.95, SRMSR values ≤ 0.08, and RMSEA values ≤ 0.06 to indicate a good fit for the data. Descriptive statistics, correlations, and independent t tests were calculated with IBM SPSS Statistics 24/25 (IBM Corp., Armonk, NY, USA), while path analyses were conducted using Mplus Version 7 (Muthén & Muthén, Los Angeles, CA, USA).

Table 1 Measures

Measures	Week of survey	Type of score	No. of items	Examples of items	Type of scale	Reference	α
Depressive symptoms	0	Sum score	12	How do you see your future? Are you disappointed with yourself? Do you have problems with sleep?	5 varying multiple-choice answers corresponding to each question	Short form of Beck's Depression Inventory (BDI; Kosunen et al. (2003); Kaltiala-Heino et al. (1999)	.878
Resilience	0	Sum score	14	I usually manage one way or the other. I am determined. I keep interest in things.	7-point Likert Scale from "Disagree strongly" to "Agree strongly"	The short version of the Resilience Scale (RS-14 [Losoi et al. 2013; G. M. Wagnild and Young 1993])	.875
Internalization of difficulties	0	Sum score	10	I worry a lot. Other people my age generally like me.	3-point Likert Scale from "Not true" to "Certainly true"	Strengths and Difficulties Questionnaire (SDQ; (A. Goodman (2015); A. Goodman et al. (2010); Goodman (1997, 2001); Koskelainen et al. (2000)	.740
Externalization of difficulties	0	Sum score	10	I get very angry. I am easily distracted.	3-point Likert Scale from "Not true" to "Certainly true"		.730
Positive outcome expectancies	10	Mean score	4	The ability to relax and calm my mind when I'm stressed, nervous or anxious Can help me be healthier. Can help me learn. Can help me perform better (e.g., in sports)	5-point Likert Scale from "Totally disagree" to "Totally agree"	Francis et al. (2004)	.807
Negative outcome expectancies	10	Mean score	2	The ability to relax and calm my mind when I'm stressed, nervous or anxious Takes time from other important things	5-point Likert Scale from "Totally disagree" to "Totally agree"	Francis et al. (2004)	.851
Perceived behavioral control	10	Mean score	4	I think I can calm my mind, even when I have an important test or speech in school. I'm stressed or in a bad mood.	4-point Likert Scale from "I am certain I cannot" to "I am certain I can"	Francis et al. (2004)	.833
Injunctive norms	10	Mean score	2	My friends think it is OK that I do the home exercises. My parents think it is OK that I do the home exercises.	5-point Likert Scale from "Totally disagree" to "Totally agree"	Francis et al. (2004)	.862
Descriptive norm	10	Single item	1	My friends do some of the exercises we learned.	5-point Likert Scale from "Totally disagree" to "Totally agree"	Francis et al. (2004)	N/A
Intention	10	Single item	1	During the next months, I will use the exercises I have learned to relax and calm my mind.	7-point Likert Scale from "Totally disagree" to "Totally agree"	(Francis et al. 2004)	N/A
Practice during the intervention	10	Mean score	11	Did you do any home exercises during the program, and how often? I practiced…Counting breaths in one minute.	6-point scale ranging from "Not once" to "Almost every day or every day"	Original to the trial	.959
Practice during weeks 10–26	26	Mean score	4	During the past half year (the time after the Well-being Learning Program), I did the following exercises at home…Long breathing exercises that lasted over 10 min.	5-point scale ranging from "Not once" to "Many times a day"	Original to the trial	.865
Practice during weeks 23–26				During the past one month (four weeks), I did the following exercises at home…Short breathing exercises that lasted under 10 min.			.885
Use of a mindfulness exercise to relax	0, 10, and 26	Single item	1	How often do you do one of the following activities to relax? 4. I do a mindfulness exercise.	4-point Likert Scale from "Not at all" to "Often"	Original to the trial	N/A

Results

Descriptive Statistics

Table 2 presents the means, standard deviations, and skewness and kurtosis scores, and Table A1 correlations in the supplementary files. Depressive symptoms and practice weeks 23–26 had a severely positively skewed and severely leptokurtic (peaked) distributions, but otherwise, variables were rather normally distributed. On average, participants had a "moderate" level of resilience (Losoi et al. 2013). Depressive symptoms were on average absent or very mild (Kosunen et al. 2003). The levels of internalization and externalization of difficulties were both "close to average" (Goodman et al. 2010). Around 7% had mild depressive symptoms, 5% had moderate, and 2% had severe. Around 35% had less than moderate resilience. Around 18% had externalization of difficulties scores higher than average, and 28% had internalization of difficulties scores higher than average.

The rest of the variables used in this study were created for the trial so the levels cannot be compared to other samples at this time. For this reason, we will just point out where on the response scale the participants scored. The mean levels of positive and negative outcome expectations were closest to the options "4. Agreed a little" and "2. Disagree a little", respectively. Injunctive norms and the descriptive norm were closest to the options "4. Agreed a little" and "2. Disagree a little," respectively. On average, participants scored closest to the option "3. I probably can" on perceived behavioral control. Intention had an average closest to the option "4. Neither agree nor disagree". The practice means were low, e.g., the respective averages for the frequency of practice during weeks 10–26 and 23–26 were closest to the option "1. Not once". Percentage frequency distributions of the practice measures can be viewed on the OSF project page.

Mental Health at Baseline

Table 3 presents the results from the mental health model for home practice from 10 to 26 weeks. Overall, initial mental health did not have an association with practice. None of the four mental health variables were related to any of the five measures of practice. For example, resilience, depressive symptoms, internalization of difficulties, and externalization of difficulties at baseline were not associated with practice during weeks 10–26. Goodness of fit was not assessed for the mental health models because they were saturated models, i.e., just-identified models with zero degrees of freedom. Similar patterns were also seen in the other measures of practice (for details, see Table A3 in the supplementary materials).

Table 2 Descriptives

	Week of survey	Range	Mean (SD)			*Skewness*	*Kurtosis*	*T* test			
			Total	Girls	Boys			*t*	*p*	*Corrected p*	*d*
1. Resilience	0	14–98	77.09 (11.35)	76.79 (11.59)	77.39 (11.11)	− 0.93	1.93	− 0.92	.357	0.714	− 0.05
2. Depressive Symptoms	0	0–39	2.17 (4.02)	2.62 (4.31)	1.71 (3.65)	3.57	17.06	3.88	.000	0.000	0.22
3. Internalization	0	0–20	4.86 (3.35)	5.21 (3.33)	4.52 (3.33)	0.81	0.50	3.59	.000	0.000	0.21
4. Externalization	0	0–20	5.53 (3.24)	5.25 (3.11)	5.80 (3.34)	0.64	0.18	− 2.99	.003	0.018	− 0.17
5. Positive outcome expectancies	10	1–5	3.72 (0.86)	3.72 (0.82)	3.72 (91)	− 0.75	0.86	0.16	.873	0.873	0.01
6. Negative outcome expectancies	10	1–5	2.39 (1.06)	2.28 (1.03)	2.52 (1.09)	0.36	− 0.55	− 3.50*	.000	0.000	− 0.22
7. Injunctive norms	10	1–5	3.68 (1.04)	3.87 (0.99)	3.49 (1.05)	− 0.54	0.03	6.23*	.000	0.000	0.37
8. Descriptive norm	10	1–5	2.46 (1.10)	2.38 (1.05)	2.56 (1.14)	0.05	− 0.90	− 2.73	.006	0.030	− 0.16
9. Perceived behavioral control	10	1–4	2.96 (0.61)	2.89 (0.59)	3.02 (0.62)	− 0.39	0.61	− 3.70*	.000	0.000	− 0.22
10. Intention	10	1–7	3.55 (1.88)	3.65 (1.86)	3.45 (1.89)	− 0.01	− 1.19	1.83	.067	0.201	0.11
11. Practice weeks 1–9	10	1–6	2.02 (1.03)	1.96 (.91)	2.09 (1.14)	1.50	2.74	− 2.13	.033	0.132	− 0.13
12. Practice weeks 10–26	26	1–5	1.49 (0.75)	1.41 (0.62)	1.59 (0.85)	1.78	3.00	− 3.75*	.000	0.000	− 0.24
13. Practice weeks 22–26	26	1–5	1.32 (0.59)	1.24 (0.45)	1.41 (0.69)	2.52	7.89	− 4.39*	.000	0.000	− 0.29
14. Use of MF	10	1–4	1.82 (0.86)	1.72 (0.81)	1.92 (0.89)	0.75	− 0.29	− 4.05*	.000	0.000	− 0.24
15. Use of MF	26	1–4	1.60 (0.83)	1.46 (0.74)	1.74 (0.90)	1.23	0.60	− 5.20	.000	0.000	− 0.34

$N = 938–1228$, $n_{girls} = 481–610$, $n_{boys} = 451–618$. *p* values corrected by Holm-Bonferroni Sequential Correction

MF mindfulness

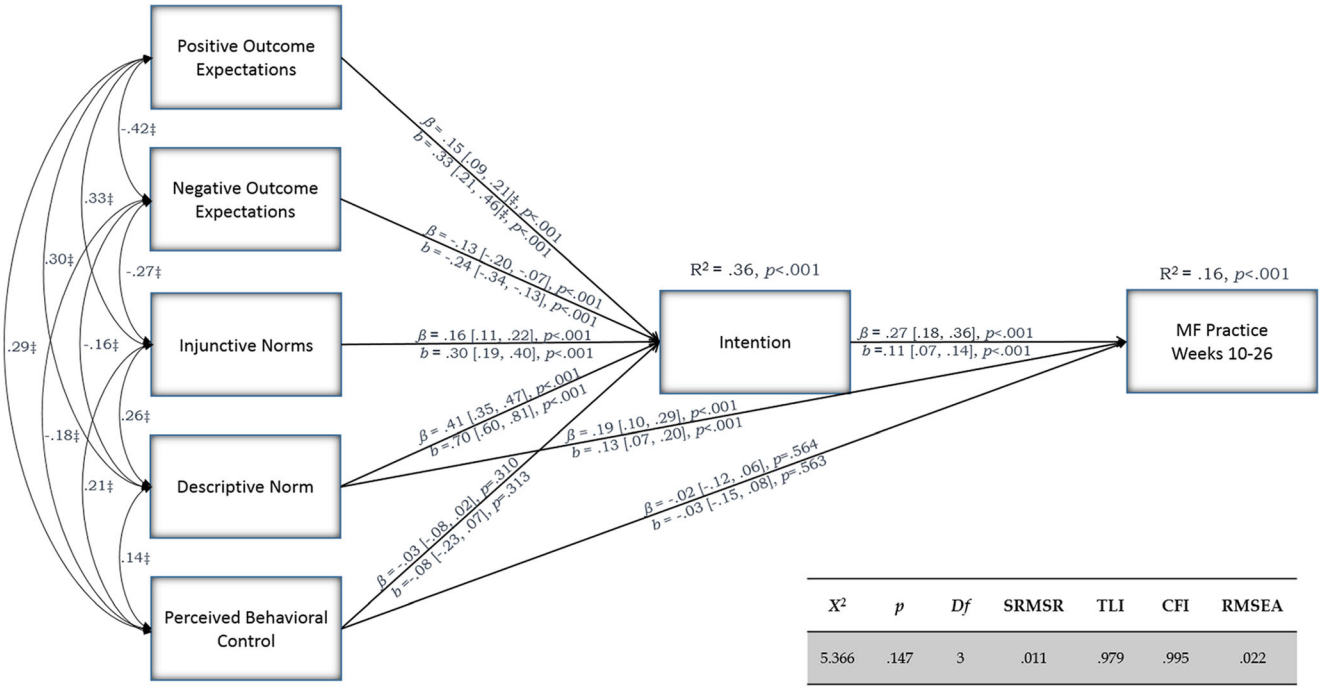

Fig. 1 The Reasoned Action Approach Model with practice during weeks 10–26. 95% CI

The Reasoned Action Approach

For the RAA model, Fig. 1 presents the direct effects and variances explained while Table 4 presents the indirect effects. Intention at 10 weeks predicted practice during weeks 10–26. Intention in turn was predicted by the social cognitive variables (except perceived behavioral control), although none of these regression relationships were particularly strong. Descriptive norms were the strongest predictor of intention of the social cognitive variables at 10 weeks. In addition, descriptive norms were directly associated with practice during weeks 10–26, while perceived behavioral control was not. A similar pattern was found in the indirect effects (via intention) of the social cognitive variables on mindfulness practice during weeks 10–26: positive outcome expectations, negative outcome expectations, injunctive norms, and descriptive

Table 3 Mental health model results

		Practice weeks 10–26					
	Gender	β	p	b [CI]	p	R^2	p
Resilience	All	0.06 [− 0.03, 0.14]	.225	0.00 [− 0.00, 0.01]	.226		
	Girls	0.07 [− 0.03, 0.17]	.169	0.00 [− 0.00, 0.01]	.167		
	Boys	0.06 [− 0.05, 0.18]	.285	0.01 [− 0.00, 0.01]	.292		
Depressive symptoms	All	− 0.00 [− 0.11, 0.11]	.945	− 0.00 [− 0.02, 0.02]	.945		
	Girls	0.06 [− 0.07, 0.19]	.356	0.01 [− 0.01, 0.03]	.351		
	Boys	0.00 [− 0.15, 0.15]	.989	0.00 [− 0.04, 0.04]	.989		
Internalization	All	0.08 [− 0.02, 0.20]	.122	0.02 [− 0.01, 0.04]	.125		
	Girls	0.06 [− 0.08, 0.19]	.389	0.01 [− 0.01, 0.04]	.389		
	Boys	0.11 [− 0.03, 0.25]	.132	0.03 [− 0.02, 0.06]	.133		
Externalization	All	0.03 [− 0.07, 0.12]	.603	0.01 [− 0.02, 0.03]	.603		
	Girls	− 0.12 [− 0.25, 0.01]	.070	− 0.02 [− 0.05, 0.00]	.071		
	Boys	0.09 [− 0.04, 0.21]	.170	0.02 [− 0.01, 0.05]	.173		
R^2	All					.01	.187
	Girls					.02	.291
	Boys					.03	.171

Table 4 The Reasoned Action Approach model results: indirect effects via intention

	Practice weeks 10–26			
	β [CI]	*p*	*b* [CI]	*p*
Positive outcome Expectancies	0.04 [.02, .06]	.000	0.04 [0.02, 0.05]	.000
Negative outcome Expectancies	− 0.04 [− 0.06, −.01]	.001	− .03 [−0.0, −0.01]	.001
Injunctive norms	0.04 [0.02, 0.06]	.000	0.03 [0.02, 0.05]	.000
Descriptive norms	0.11 [0.07, 0.15]	.000	0.08 [0.05, 0.10]	.000
Perceived behavioral control	− 0.01 [− 0.02, .01]	.317	− 0.01 [− 0.03, 0.01]	.322

norms indirectly predicted mindfulness practice through intention, while perceived behavioral control did not.

The variance explained by the model with the practice measure at 23–26 weeks was also significant, albeit the strength of the relationship between intention at 10 weeks and practice decreases with time. A similar pattern was also found with the single-item measure of mindfulness practice at 26 weeks, apart from there not being a direct association between the descriptive norm and use of a mindfulness practice to relax at the 26-week survey. Overall, the RAA models had adequate fit with the data. Only perceived behavioral control did not predict intention or practice indirectly or directly. We also conducted analyses with other measures of practice, and these results were essentially similar, as were the results of models controlling for past behavior (see the OSF project page). See Figs. A1-A4 and Table A3 in the supplementary materials for more details.

Gender Differences in Variable Levels

There were no gender differences in the mean levels of resilience, positive outcome expectancies, intention, descriptive norms, externalization of difficulties, or practice during the program (weeks 1–9) (Table 2). Compared to boys, girls on average reported higher levels of depressive symptoms (d = 0.22), internalization of difficulties (d = 0.21), and injunctive norms (d = 0.37), and significantly lower negative outcome expectations (d = − 0.22) and perceived behavioral control (d = − 0.22). Girls also reportedly significantly less practice during weeks 10–26 (d = − 0.24) and weeks 23–26 (d = − 0.29) and less use of a mindfulness exercise to relax at 10 weeks (d = −0.24) and 26 weeks (d = −0.34). None of the average gender differences were large.

Gender Differences in the Mental Health Model

Results from chi-square difference tests indicated that there were no significant gender differences in the mental health model (e.g., practice weeks 10–26 [$\Delta\chi^2 = 9.27$, $p = .055$]; practice weeks 23–26 [$\Delta\chi^2 = 6.96$, $p = .138$]; use of mindfulness to relax at 26 weeks [$\Delta\chi^2 = 6.00$, $p = .199$]). See Tables 3 and A3 (additional practice measures are in the supplementary materials) for gender-stratified regression coefficients.

Gender Differences in the Reasoned Action Approach Model

Chi-square difference tests indicated no significant gender differences in the RAA pathway models (e.g., practice weeks 10–26 [$\Delta\chi^2 = 10.67$, $p = .221$]]; practice weeks 23–26 [$\Delta\chi^2 = 13.10$, $p = .108$]; use of mindfulness to relax at 26 weeks [$\Delta\chi^2 = 11.91$, $p = .155$]). See Fig. 2 for the gender-stratified direct effects and the amount of variance explained. The one notable difference is that outcome expectations are significantly associated with intention for girls but not for boys.

Discussion

This study examined predictors of mindfulness practice uptake among adolescents. None of the mental health variables at baseline predicted mindfulness practice linearly. Predictors from the RAA (Reasoned Action Approach), however, explained some of the variance in practice and most hypothesized relationships in the RAA were supported by these data, although the relationships were moderate in size. The descriptive norm item was the strongest predictor of intention and practice with a medium effect size. Some small gender differences were found in levels of the social cognitions, mental health, and practice, but not in the predictive models. These findings are discussed in more detail in the following paragraphs. Our analyses found some differences between those with and without missing data at follow-up with regard to grade level and socio-emotional functioning at baseline. While we did use Full Information Maximum Likelihood to handle missing data, it is possible that our findings could generalize less well to seventh graders and those with lower internalization and higher externalization.

Initial mental health, as measured by resilience, depressive symptoms, and internalization and externalization of

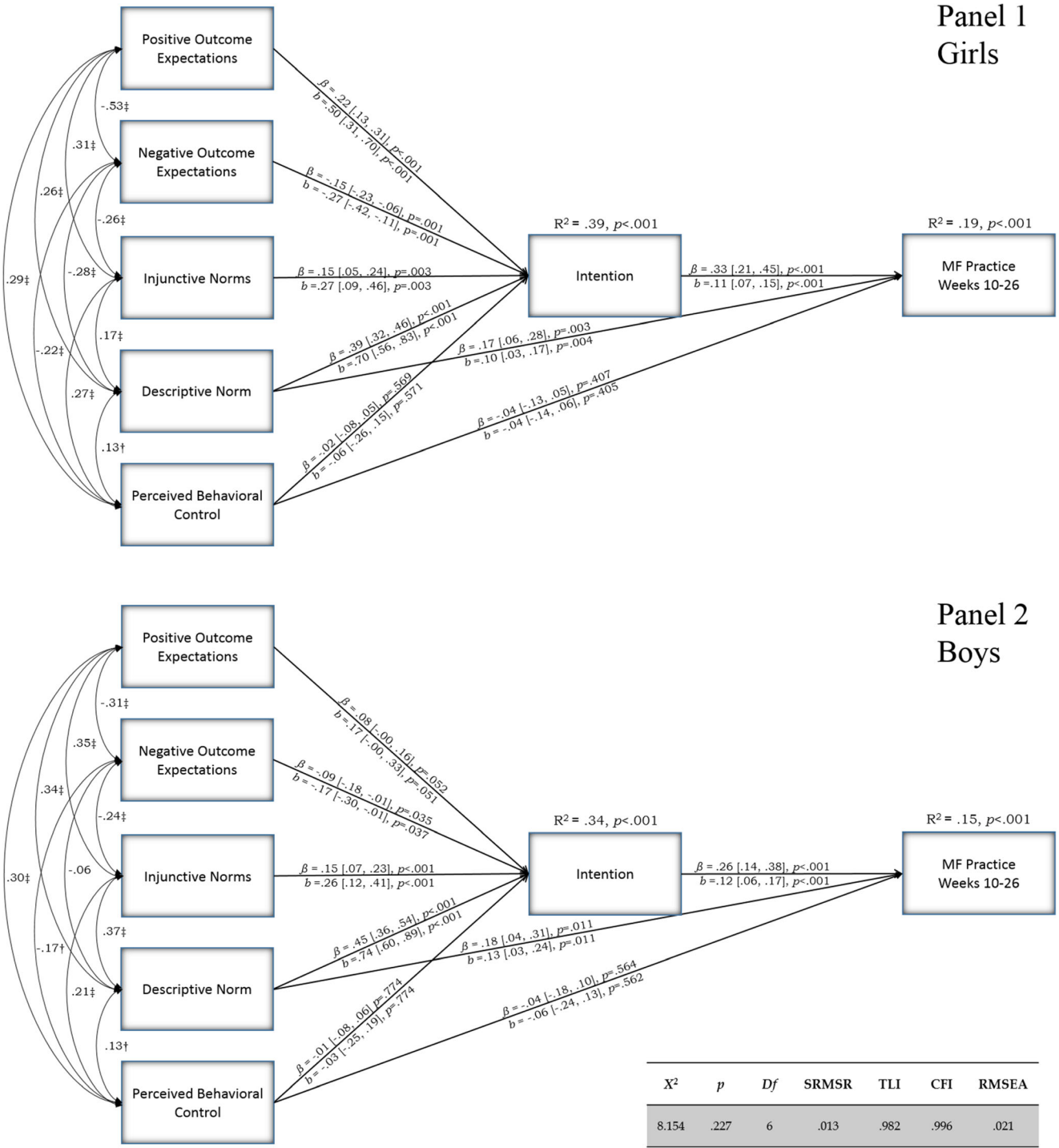

Fig. 2 The Reasoned Action Approach model with practice during weeks 10–26 by gender. 95% CI

difficulties, was examined to discover how it might affect mindfulness practice. As previously noted, our analyses revealed no significant relationships between any of these mental health variables and mindfulness practice. Having mental health problems could provide a reason for practicing on the one hand, but on the other, depressive symptoms could affect beliefs about whether practicing would help, or attentional problems could make practicing more difficult. It is possible that the conflicting influences of the stimulating and debilitating effects of having mental health problems (see the discussion in the Introduction section) had a neutralizing effect or curvilinear relationship that was not detected in these linear analyses. Correlations between the mental health variables and outcome expectations were higher than the correlations between the mental health and mindfulness practice variables, hinting that poor mental health could adversely affect outcome

expectations and thereby lead to reduced mindfulness practice. We cannot exclude the possibility that the null result is a statistical artifact, as initial mental health problems were low in this sample. More detailed investigations among individuals with mental health problems (e.g., depression, anxiety) could reveal a different pattern of results.

In answer to the second research question, the RAA model statistically significantly explained the variance in intention and practice. Individual social cognitive variables predicted intention with small to medium effect sizes with the exception of perceived behavioral control, which did not predict intention. In addition, descriptive norms predicted practice behavior directly with a small-medium effect in some analyses, while perceived behavioral control did not. This result indicates the applicability of the Reasoned Action Approach to mental health-promoting practices, which past research with varying ages and smaller sample sizes had lent preliminary but inconsistent support to (Beattie et al. 2019, Bistricky et al. 2018, Erbe et al. 2018, 2019, Lederer and Middlestadt 2014, Rizer et al. 2016).

The relatively strong influence of descriptive norms in our analyses may be related to the age group of the participants (Rivis and Sheeran 2003). Individuals in this age group demonstrate an enhanced inclination toward conformity (Knoll et al. 2015). Showing examples of peers who are practicing and making practice a norm could be an important component of interventions to promote practice (Beattie et al. 2019).

Perceived behavioral control, by contrast, was the only individual predictor in the RAA found to not significantly predict mindfulness practice and intention. It is possible that the measure of perceived behavioral control did not tap into the concept as this measure uses "the ability to relax and calm my mind" as a proxy for mindfulness exercises or practice. However, a past study on uptake of mindfulness practice among adolescents with a better measure also suggested that perceived behavioral control could be less important for behavior adoption than continuation (Erbe et al. 2019).

While there were no differences in positive outcome expectations, boys reported significantly higher negative outcome expectations. Upon closer inspection, one item ("The ability to relax and calm my mind when I'm stressed, nervous, or anxious…Does not help me in any way") seemed to drive this gender difference. Among boys, there seemed to be more individuals reporting beliefs of a total lack of benefits than among girls. The HLM trial also found slightly greater benefits for girls in resilience (Volanen et al. 2020). This is congruent with previous research that indicates on average, men do not experience mindfulness benefits such as reduction in negative affect as much as women, attributing it to women's higher tendency to ruminate and internalize (Rojiani et al. 2017). Girls did indeed have higher internalization scores in our study. Rojiani et al. (2017) suggest that mindfulness practice helps women to be more self-compassionate ameliorating their struggles with internalizing and ruminating, whereas it helps men to describe and distinguish emotions, which could have positive, negative, or neutral consequences.

While girls reported higher injunctive norms than boys, there were no gender differences in descriptive norms after correcting for multiple comparisons. Although gender differences regarding descriptive and injunctive norms about mindfulness practice have not been studied before as far as our searches could find, girls on average have been found to have higher social evaluative concerns, which has been linked to depressive symptoms (Rudolph and Conley 2005). Future research could investigate whether gender differences also exist in response to the intervention strategies to alter descriptive and injunctive norms. Boys reported more frequent mindfulness practice on all measures of practice, save the measure of practice during the intervention.

Finally, in response to the secondary research questions about gender effects in the models, neither the initial mental health nor the RAA and mindfulness practice model differed much between genders. Although there were some gender differences in the levels of variables (e.g., depressive symptoms, negative outcome expectations), there were no gender differences in predictive relationships, suggesting applicability of RAA as a theory across genders. All in all, gender differences were minor, and the inter-individual variability may well be greater than gender differences.

Strengths, Limitations, and Future Research Directions

The current study evaluates behavioral theory in the area of mindfulness practice across such a large study of adolescent intervention recipients. As such, it contributes to an under-researched area (i.e., investigating behavioral theory in relation to mindfulness practice as a behavior) that can improve mental health-fortifying programs and lends support to the results of an earlier study using a subsample of data from this same trial (Beattie et al. 2019). Another strength of the study is a relatively long, 26-week follow-up, which extends beyond the average of 13.2 weeks across other school-based mindfulness programs (Felver et al. 2016). Researchers constructing future school-based mindfulness interventions can use these results to increase uptake of mindfulness practice in their interventions by paying special attention to social norms and outcome expectations. Then with more practice, the potential well-being and cognitive benefits can be more properly assessed.

Despite these strengths however, several limitations persist. Creating mean scores of the more specific practice items and the more general items inquiring about practice obscure the intensity of each exercise. For example, Beditation and the seated-body scan are longer, formal practices with their length set via a sound file. They are more intense than a short, informal exercise, e.g., mindful walking. (See the note under Table A2 for further discussion of the practice variables.) The practice

measures differ at different time periods, because the researchers reasoned that they could get more detailed information about each specific measures directly after the intervention than 26 weeks later when the specific names may have been forgotten. The aforementioned problem with the measure of perceived behavioral control operationalized in relation to the ability to calm the mind rather than the ability to do a mindfulness exercise, also applies to the measures of outcome expectations and intention to some extent. For these measures, the target or objective is calming the mind rather than mindfulness exercises. Future studies should use measures that refer to practice behavior only. These measures are also limited as they do not fully adhere to the Target, Action, Context, and Time (TACT) principle suggested by Ajzen (2006). For example, a more fitting formulation for intention may have been: "I will use the exercises I have learned in my leisure time."

Future research could explore several avenues. For one, it could examine a wider range of potential influences on mindfulness practice behaviors, across several various theoretical constructs that have been linked to behavior, e.g., theoretical domains framework (Cane et al. 2012). In terms of motivation to practice mindfulness, a further avenue—in addition to predicting amount of motivation as in RAA—could be to investigate the prevalence and role of *quality* of motivation (Ryan and Deci 2017). In other words, attention to the autonomous vs. controlled forms of motivational regulation involved in mindfulness practice uptake could affect how interventions are developed. Various school-based programs can instill them in different ways, e.g., a school-based program could instill controlled motivation by implementing rewards or punishments for completing mindfulness exercises, or it could instill autonomous motivation by showing how mindfulness practice can become enjoyable. In addition, future research can delve deeper into the role of descriptive norms. In this study, facilitators asked who had done the mindfulness homework. Assessing these discussions would increase our knowledge of the formation of descriptive norms. It could be that the degree of optionality of practicing (i.e., if it is given as regular homework or only a recommendation) affects how influential descriptive norms are. More practice in the sessions could also influence descriptive norms. Future school-based mindfulness interventions could test these possibilities as well as peer mentoring to target descriptive norms. Involving teachers and parents in practicing outside of the sessions are other avenues to explore. Parental involvement may be a major predictor of mindfulness uptake in this age range (e.g., Saltzman and Goldin 2008; Singh et al. 2010), and the lack of parental involvement in this trial is a limitation. We also encourage more qualitative research to more deeply understand barriers and facilitators of daily practice, e.g., why the exercises are or are not perceived as helpful.

Future research should be cognizant of the difficult decisions and trade-offs when constructing measures as in the cases of perceived behavioral control and outcome expectations in this study. The development and validation of a standard scale to measure RAA constructs in the context of mindfulness practice would improve future research in this area. In samples already familiar with mindfulness practice, an elicitation study of salient beliefs as recommended by Ajzen (2006) would help to ensure that the items tap into relevant beliefs for the participants (see Erbe et al. 2018, 2019 for a couple starts in this direction). Future measures could also include other components of the social cognitive variables such as experiential attitudes (another component of outcome expectations) and autonomy/controllability (another component of perceived behavioral control). Experiential attitudes would clarify how enjoyable, boring, frustrating, etc., mindfulness practice is for the adolescents. Autonomy/controllability would elucidate how much practicing mindfulness is perceived to be in their control.

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Author Contributions MB: analyzed the data and wrote the paper. HK: collaborated with the statistical analyses and critically revised the manuscript. SMV: as the PI of the HLM project, facilitated the data acquisition and provided guidance in the writing and editing of the manuscript. KK: made substantial contributions to study design and critically revised the manuscript for important intellectual content. NH: conceived of the study and its design, as well as critically revised the manuscript for important intellectual content. All the authors read and approved the final manuscript.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Informed Consent Informed consent was obtained from all individual participants and their parents/ guardians. Participants were informed that participation was voluntary.

Ethical Approval All procedures performed in studies involving human participants were approved by the humanities and social and behavioral

sciences ethical review board of the University of Helsinki (Statement 1/2014) as well as the department of education in the each school district. They were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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